IN THE CLAIMS:

The claims have been amended as follows:

1. (Currently Amended) A quadrature phase modulation receiver for a spread spectrum communications system, the receiver comprising:

(a) a mixer for mixing a received spread spectrum signal with a heterodyne signal to convert the frequency of the received spread spectrum signal to an intermediate frequency and thereby produce a received signal having the intermediate frequency, the received spread spectrum signal including a carrier signal modulated by a data signal and being spread by a spreading code;

(b) a regulated oscillators module coupled to the mixer for producing the heterodyne signal and an intermediate frequency signal;

(c) a frequency multiplier coupled to the mixer for receiving the ~~intermediate frequency~~ frequency received signal having the intermediate frequency and multiplying the frequency of the received signal having the intermediate frequency by a fixed multiplication factor to produce a frequency multiplied signal, wherein the frequency-multiplied signal has a phase that does not depend on a phase of the data signal, wherein the frequency multiplied signal produced by the frequency multiplier is characterized by the following expression:

$$(\cos(4\omega t + 4\varphi)) / 2,$$

where ω is the frequency of the received signal having the intermediate frequency and φ is the initial phase of the received signal having the intermediate frequency; and

(d) means for producing an oscillator control signal based on the frequency multiplied signal output from the frequency multiplier, wherein the regulated oscillators module produces the intermediate frequency signal based on the oscillator control signal.

7 2. (Currently Amended) A quadrature phase modulation receiver for a spread spectrum communications system, the receiver comprising:

(a) a mixer for mixing a received spread spectrum signal with a heterodyne spread spectrum signal to convert the frequency of the received signal to an intermediate frequency and thereby produce a received signal having the intermediate frequency;

(b) a regulated oscillators module coupled to the mixer for producing the heterodyne signal and an intermediate frequency signal;

(c) a frequency multiplier coupled to the mixer for receiving the received signal having the intermediate frequency and multiplying the frequency of the received signal having the intermediate frequency by a predetermined multiplication factor to produce a frequency multiplied signal; and

(d) means for producing an oscillator control signal based on the frequency multiplied signal output from the frequency multiplier, wherein the regulated oscillators module produces the intermediate frequency signal based on the oscillator control signal, wherein the means for producing an the oscillator control signal comprises:

(i) a phase shifter coupled to the frequency multiplier for receiving the frequency multiplied signal and shifting the phase of the frequency

multiplied signal by a predetermined amount to produce an output signal;

(ii) a comparison signal formation circuit for receiving the intermediate frequency signal output from the regulated oscillators module and for producing an output signal having a predetermined relationship with the intermediate frequency signal; and

(iii) a frequency and phase discriminator for receiving the output signals from the phase shifter and the comparison signal formation circuit and for producing the oscillator control signal based on the output signals from the phase shifter and the comparison signal formation circuit.

3. (Canceled)

4. (Original) ~~The quadrature phase modulation receiver of claim 3~~ A quadrature phase modulation receiver for a spread spectrum communications system, the receiver comprising:

(a) a mixer for mixing a received spread spectrum signal with a heterodyne signal to convert the frequency of the received signal to an intermediate frequency and thereby produce a received signal having the intermediate frequency;

(b) a regulated oscillators module coupled to the mixer for producing the heterodyne signal and an intermediate frequency signal;

(c) a frequency multiplier coupled to the mixer for receiving the received signal having the intermediate frequency and multiplying the frequency of

received signal having the intermediate frequency by a predetermined multiplication factor to produce a frequency multiplied signal; and

(d) means for producing an oscillator control signal based on the frequency multiplied signal output from the frequency multiplier, wherein the regulated oscillators module produces the intermediate frequency signal based on the oscillator control signal, wherein the received signal is a quadrature phase modulated signal and the frequency multiplier is a 4x frequency multiplier, and wherein the 4x frequency multiplier comprises:

[[(a)]](i) a first ~~power~~ multiplier for squaring (the ~~intermediate frequency~~ received) signal output from the mixer to produce a squared signal;

[[(b)]](ii) a first DC blocking capacitor for removing DC offset components from the squared signal;

[[(c)]](iii) a second multiplier for squaring the squared signal to produce a third output signal having a frequency that is four times the frequency of the intermediate frequency signal; and

[[(d)]](iv) a second DC blocking capacitor coupled to the second [[power]] multiplier for removing DC components from the third output signal to produce the frequency multiplied signal.

5. (Original) The quadrature phase modulation receiver of claim 1 wherein the regulated oscillators module comprises:

~~(a)~~ a heterodyne signal oscillator for producing the heterodyne signal;

(b) a voltage controlled oscillator (VCO) for producing an output signal having a predetermined relationship with the intermediate frequency; and

(c) a frequency synthesizer for receiving the output signal from the VCO and for producing the intermediate frequency signal.

6. (Original) The quadrature phase modulation receiver of claim 5 wherein the voltage controlled oscillator is adapted to receive the oscillator control signal and produce the output signal based on the oscillator control signal.

8 7. (Original) The quadrature phase modulation receiver of claim 2 7 wherein the comparison signal formation circuit comprises first and second squaring circuits and a multiplier circuit connected in series for receiving and processing the intermediate frequency signal output from the regulated oscillators module.

9 8. (Original) The quadrature phase modulation receiver of claim 7 8 wherein:

(a) the first squaring circuit comprises a first voltage multiplier having first and second inputs connected to each other and having a first output;

(b) the second squaring circuit comprises a second voltage multiplier having third and fourth inputs connected to each other and to the first output and having a second output; and

(c) the multiplier circuit comprises a three-input multiplier having a first input coupled to the first output, a second input coupled to the second output, and a third input coupled to the ~~phase shifter~~ regulated oscillators module.

9. (Original) The quadrature phase modulation receiver of claim 1 comprising:

(e) a phase discriminator for receiving the signal output from the mixer and the intermediate frequency signal and producing a signal indicative of transmitted data and a spreading code; and

(f) a demodulator for receiving the signal output from the phase discriminator and removing the spreading code.

10. (Original) The quadrature phase modulation receiver of claim 9, wherein the demodulator comprises a frequency hopping spread spectrum demodulator.

11. (Original) The quadrature phase modulation receiver of claim 9 wherein the demodulator comprises a direct sequence spread spectrum demodulator.

12. (Currently Amended) A method for maintaining synchronization between a quadrature phase modulation spread spectrum transmitter and a quadrature phase modulation spread spectrum receiver, the method comprising:

at the quadrature phase modulation spread spectrum receiver:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal to produce an oscillator control signal, wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying a frequency of the intermediate frequency signal by a fixed multiplication factor and

wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes producing the intermediate frequency signal characterized by the following equation:

$$(\cos(4\omega t + 4\varphi)) / 2,$$

where ω is the frequency of the intermediate frequency signal and φ is the initial phase of the intermediate frequency signal;

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

13. (Canceled)

14. (Canceled)

14 15. (Currently Amended) ~~The method of claim 14~~ A method for maintaining synchronization between a quadrature phase modulation spread spectrum transmitter and a quadrature phase modulation spread spectrum receiver, the method comprising:

at the quadrature phase modulation spread spectrum receiver:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal

to produce an oscillator control signal, wherein removing influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying the frequency of the intermediate frequency signal by a predetermined multiplication factor, wherein multiplying the frequency of the intermediate frequency signal by the a predetermined multiplication factor includes multiplying the intermediate frequency signal by a factor of four to produce a frequency multiplied signal, wherein producing the oscillator control signal includes:

[[(a)]](i) shifting the phase of the frequency multiplied signal by a predetermined amount to produce a phase-shifted signal; and

[[(b)]](ii) producing the oscillator control signal based on the phase-shifted signal;

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

15 16. (Original) The method of claim 14 15 wherein generating the a synchronization signal comprises generating a signal having a frequency equal to the frequency of the intermediate frequency signal based on the oscillator control signal.

16 17. (Currently Amended) ~~The method of claim 14~~ A method for maintaining synchronization between a quadrature phase modulation spread spectrum

transmitter and a quadrature phase modulation spread spectrum receiver, the method comprising:

at the quadrature phase modulation spread spectrum receiver:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal to produce an oscillator control signal, wherein removing influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying the frequency of the intermediate frequency signal by a predetermined multiplication factor, wherein multiplying the frequency of the intermediate frequency signal by the predetermined multiplication factor includes multiplying the intermediate frequency signal by a factor of four to produce a frequency multiplied signal, wherein multiplying the frequency of the intermediate frequency signal by the factor of four includes:

[[(a)]](i) squaring the intermediate frequency signal to produce a squared signal;

[[(b)]](ii) filtering out constant components from the squared signal;

[[(c)]](iii) squaring the squared signal to produce a signal having a frequency equal to four times the frequency of the intermediate frequency signal; and

[[(d)]](iv) filtering out constant components from the signal having the frequency of the signal frequency equal to four times the intermediate frequency;

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

12 18. (Original) The method of claim 11 wherein demodulating the quadrature phase modulated spread spectrum signal includes outputting the signal to a frequency hopping spread spectrum demodulator. quadrature phase modulated spread spectrum

13 19. (Original) The method of claim 11 wherein demodulating the quadrature phase modulated spread spectrum signal includes outputting the signal to a direct sequence spread spectrum demodulator. quadrature phase modulated spread spectrum

17 20. (Currently Amended) A computer program product comprising computer-executable instructions embodied in a computer-readable medium for performing steps comprising:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal to produce an oscillator control signal, wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying a frequency of

the intermediate frequency signal by a fixed multiplication factor and wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes producing ~~an~~ the intermediate frequency signal characterized by the following equation:

$$(\cos(4\omega t + 4\varphi)) / 2,$$

where ω is the frequency of the intermediate frequency signal and φ is the initial phase of the intermediate frequency signal;

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

21. (Canceled)

22. (Canceled)

23. (Currently Amended) ~~The computer program product of claim 22~~ A computer program product comprising computer-executable instructions embodied in a computer-readable medium for performing steps comprising:

at a quadrature phase modulation spread spectrum receiver:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal

to produce an oscillator control signal, wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying the frequency of the intermediate frequency signal by a predetermined multiplication factor, wherein multiplying the frequency of the intermediate frequency signal by ~~a~~ the predetermined multiplication factor includes multiplying the intermediate frequency signal by a factor of four to produce a frequency multiplied signal; wherein producing the oscillator control signal includes:

[[(a)]](i) shifting the phase of the frequency multiplied signal by a predetermined amount to produce a phase-shifted signal; and

[[(b)]](ii) producing the oscillator control signal based on the phase-shifted signal;

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

21 ~~24~~. (Original) The computer program product of claim 20 ~~23~~ wherein generating ~~a~~ the synchronization signal comprises generating a signal having a frequency equal to the frequency of the intermediate frequency signal based on the oscillator control signal.

22 ~~25~~. (Currently Amended) ~~The computer program product of claim 22~~ A computer program product comprising computer-executable instructions embodied in a computer-readable medium for performing steps comprising:

at a quadrature phase modulation spread spectrum receiver:

(a) receiving a quadrature phase modulated spread spectrum signal;

(b) mixing the quadrature phase modulated spread spectrum signal with a heterodyne signal to produce an intermediate frequency signal;

(c) removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal to produce an oscillator control signal, wherein removing the influence of data changes in the quadrature phase modulated spread spectrum signal from the intermediate frequency signal includes multiplying the frequency of the intermediate frequency signal by a predetermined multiplication factor, wherein multiplying the frequency of the intermediate frequency signal by ~~a~~ the predetermined multiplication factor includes multiplying the intermediate frequency signal by a factor of four to produce a frequency multiplied signal; wherein multiplying the frequency of the intermediate frequency signal by ~~a~~ the factor of four includes:

[[(a)]](i) squaring the intermediate frequency signal to produce a squared signal;

[[(b)]](ii) filtering out constant components from the squared signal;

[[(c)]](iii) squaring the squared signal to produce a signal having a frequency equal to four times ~~the~~ the frequency of intermediate frequency; signal and

[[(d)]](iv) filtering out constant components from the signal having a frequency equal to four times the intermediate frequency; the frequency of signal

(d) generating a synchronization signal based on the oscillator control signal; and

(e) demodulating the quadrature phase modulated spread spectrum signal using the synchronization signal.

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26. (Original) The computer program product of claim 20 wherein demodulating the quadrature phase modulated spread spectrum signal includes outputting the quadrature phase modulated spread spectrum signal to a frequency hopping spread spectrum demodulator.

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27. (Original) The computer program product of claim 20 wherein demodulating the quadrature phase modulated spread spectrum signal includes outputting the quadrature phase modulated spread spectrum signal to a direct sequence spread spectrum demodulator.

28. (Canceled)

29. (Canceled)

30. (Canceled)